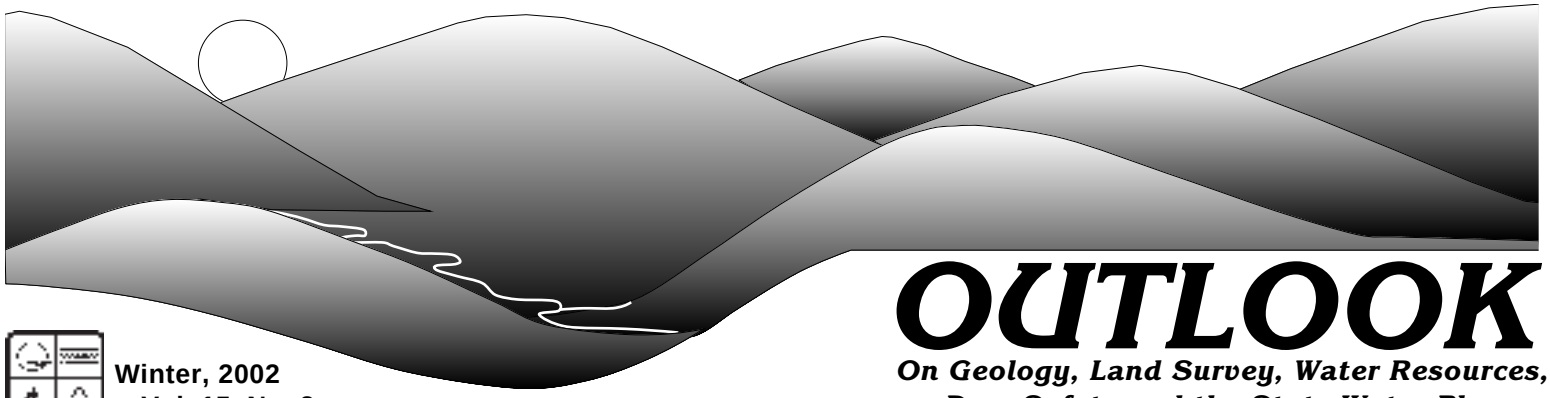
MISSOURI DEPARTMENT OF NATURAL RESOURCES / GEOLOGICAL SURVEY AND RESOURCE ASSESSMENT DIVISION



OUTLOOK

On Geology, Land Survey, Water Resources, Dam Safety and the State Water Plan

Winter, 2002
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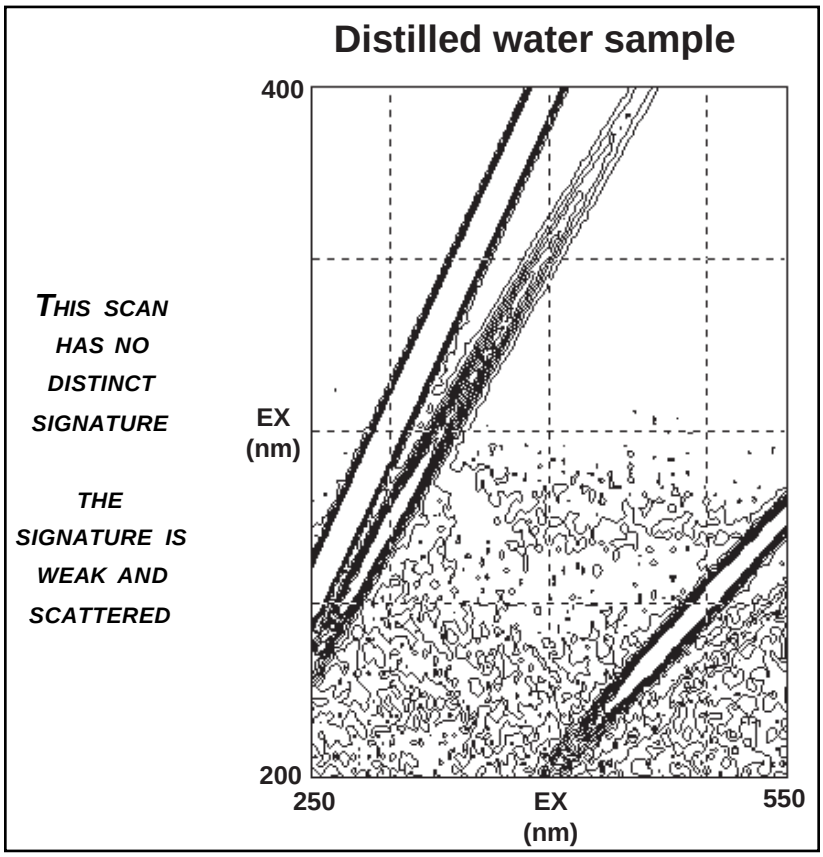
INSIDE:

GEOLOGICAL SURVEY AND RESOURCE ASSESSMENT DIVISION USES THREE DIMENSIONAL FLUORESCENCE SPECTROSCOPY TO SCREEN FOR THE PRESENCE OF ORGANIC WASTES IN WATER

In 1995 the Geological Survey and Resource Assessment Division (GSRAD) began working on a study in support of the Department of Natural Resources, Solid Waste Management Program to evaluate the impacts of the Great Flood of 1993 on Missouri landfills. The study was funded through a grant provided by the US Environmental Protection Agency.

A portion of the study focused on the use of fluorometric methods to determine the difference between water impacted by landfill leachate [liquids that seep or flow from landfills] from unaffected water. The techniques used for this study were generated by GSRAD from a combination of two previously developed methods used to determine the presence of fluorescent organics in water. Such organics exhibit the ability to emit a bright or glowing color due to the absorption of particles of radiation. Since the early 1980s, GSRAD has been active in developing instrumental techniques in fluorescent tracer detection to determine groundwater connections. This has been integrated with long accepted techniques using fluorescent spectrometers equipped for simultaneous scanning to determine the difference in fluorescent materials in the environment such as petroleum. Fluorescent spectrometers are instruments that measure the wave lengths of particles of radiation emitted by substances.



During this study fluorescence spectroscopy was used to detect fluorescent indicators of organic wastes in water, specifically those affected by landfill leachate. These indicators are not necessarily "contaminants" in the classical sense, but they can be used to determine potential contaminant sources. The techniques developed here use characteristic signatures for different waste types based on the amount of fluorescence present. Water samples collected from sanitary landfill leachate collection systems and landfill gas collection systems, were analyzed using a Hitachi Model F-4500 fluorescence spectrophotometer. Wastewater treatment systems and other organic sources thought not to be the same were also examined. A three-dimensional map was created based on the intensity of the fluorescence. Specific ranges of fluorescent wavelengths were selected from broad spectrofluorometric scans to isolate areas of the contour plot that show maximum effects from organic wastes. Numerous scans of known waste types then underwent comparative analysis to look for similarities and

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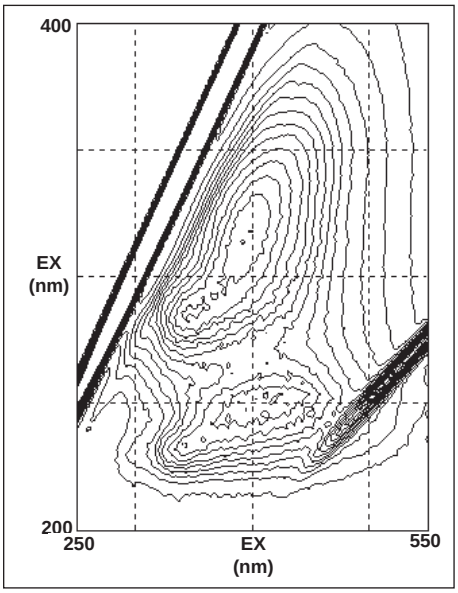
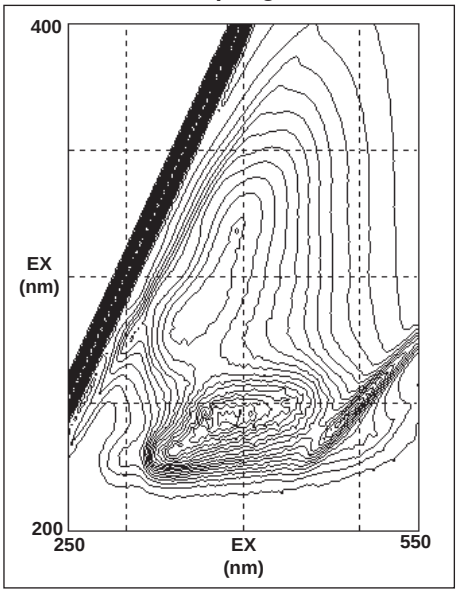
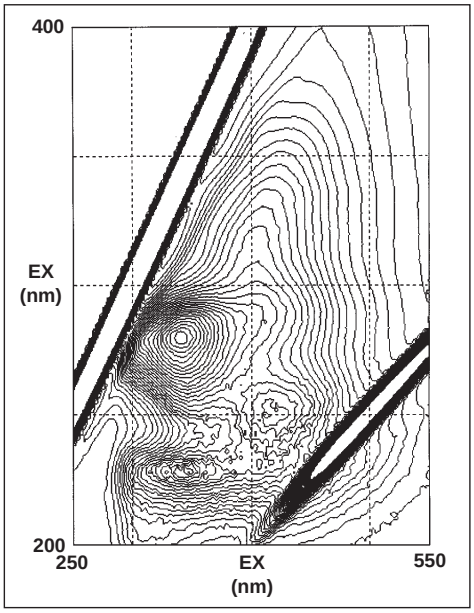
Fluorescence Contour Diagrams of Leachate

Undiluted leachate sample from Renfro Landfill



Suspected leachate sample from Brown Spring diluted 2:1





Hog Lagoon Sample from a Premium Standard Farms Waste Holding Cell

differences. The result was a surprisingly accurate tool that could determine if a water source contained significant amounts of waste, and what general type of waste was contained therein. Ongoing use of these techniques has proven to be quick, effective, and sensitive in determining presence and general type of waste contained in a water source. This has been used to minimize the number and types of wet chemistry analyses required for a study area and optimize the location of wet chemistry samples.--Joe Gillman and Jerry Prewett

"RIVER VALLEY BASELINE" -- NEW EDM BASELINE FOR SAINT LOUIS

The Department of Natural Resources' Land Survey Program has established the new *River Valley Baseline* for calibration of Electronic Distance Meter (EDM) survey instruments. The new baseline is located along River Valley Drive approximately one mile southwest of the Page Avenue Extension in Northwest Saint Louis County. The new baseline resulted from a cooperative effort by the Department of Natural Resources and Saint Louis County Highways and Traffic. Documentation, including specific directions to reach the baseline, is available from the department's Land Survey Program at (573) 368-2300.

J.T. Merseal, PLS, who coordinates the EDM calibration program for Saint Louis County Highways and Traffic, became concerned that increased traffic and development pressures are complicating use of the Chesterfield Baseline along Highway 40 through the gumbo bottoms. Merseal and Joe Heenan, PLS, Chief of Surveys, contacted Mike Flowers, PLS, State Land Surveyor, at the Department of Natural Resources to suggest a cooperative effort to create a new EDM baseline prior to the Chesterfield Baseline becoming unusable. The department expressed support for a cooperative project and the resulting baseline establishment project could serve as an example for other parts of Missouri where a new EDM baseline may be needed.

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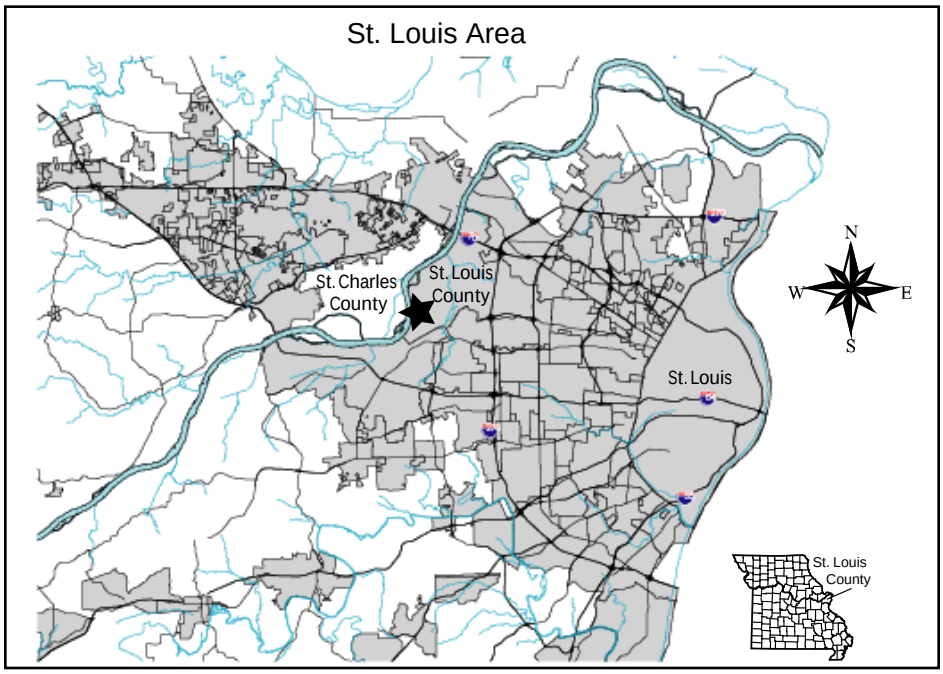
St. Louis Area



River Valley Baseline continued...

Merseal and Heenan obtained authorization from Saint Louis County Highways and Traffic to participate in a cooperative baseline establishment project with the Department of Natural Resources' Land Survey Program, and subsequently evaluated several potential baseline sites to determine suitability. This new baseline ultimately consists of four monuments over roughly 1100 meters. Baseline calibration monuments must be in a straight line horizontally with a reasonably constant slope running vertically through the four monuments. The baseline must not be subject to routine visual blockage by crossing traffic or obstructions. A new baseline also needs to be reasonably free from potential adverse affects due to future development, including utility lines that often run in highway right of ways. These requirements are further complicated by the need for easy access by all land surveyors.

During a site visit in Oct. 2001 to evaluate one of the ultimately rejected sites, Merseal and Heenan met with L.G. Loos of Maryland Heights. Loos suggested that they evaluate possible sites along River Valley Drive, and offered to spearhead approvals from Maryland Heights, which maintains River Valley Drive. In Nov. 2002, Bruce Carter, PLS, from the Department of Natural Resources met with Merseal and Heenan on River Valley Drive. Carter and his field crew set nails at the approximate location of the desired calibration monuments. Mike Paur, the Utility Coordinator of Saint Louis County Highways and Traffic, Division of Construction, contacted the utility companies and received verification that no utilities would be disturbed by the proposed baseline monuments.

In Dec. 2001, Bruce Carter of the Land Survey Program met with a survey crew from Saint Louis County Highways and Traffic to physically install the four calibration monuments. Saint Louis County provided the concrete and labor. The department provided aluminum tablets and verified the proper installation methods. During Jan. 2002, Bruce Carter returned with his field crew to make measurements of the baseline monuments. Also during January, survey personnel from Saint Louis County Highways and Traffic ran level loops to the monuments.

The Department of Natural Resources subsequently created and published the new "River Valley Baseline" as part of their statewide system of EDM baselines. Saint Louis County Highways and Traffic has been utilizing the baseline since April 2002 for their EDM calibration program. Interested surveyors can obtain documentation on the new baseline from the Department of Natural Resources' Land Survey Program at (573) 368-2300. Individuals or groups can also contact the department's Land Survey Program to inquire about the potential for cooperative projects in other parts of Missouri.

ALASKAN EARTHQUAKE AFFECTS MISSOURI

The large, magnitude 7.9 earthquake that struck a remote area in central Alaska on Sunday, Nov. 3, 2002, at about 4:13 p.m. had noticeable impacts here in Missouri, according to the Missouri Department of Natural Resources. Staff in the department's Geological Survey and Resource Assessment Division have received reports from citizens and from water well drillers.

Numerous wells have developed muddy or cloudy water. "Large distant earthquakes can affect water levels in wells and can cause sediments in the rock and soil to be shaken and suspended in well water," said Dave Hoffman, an earthquake geologist. "Reports and records document these same phenomena from the Good Friday earthquake, a 9.2 magnitude event, that took place in Alaska in 1964."

In 1964, the Geological Survey's groundwater level monitoring network had several wells where the water level fluctuated significantly. The same thing has happened as a result of the recent Alaskan earthquake. Geologists examined data from the groundwater level monitoring network and found significant changes in water level in at least 21 of the more than 70 wells that are in the monitoring network. These wells are located in 19 different counties, primarily in southern Missouri.

Water levels went up in some wells and down in others. Changes in the water level ranged up to 2 feet. It takes only a matter of minutes for shock waves to travel through the earth from Alaska to Missouri. The water level effects started between 4:30 and 5 p.m. that day.

Late that afternoon, a Harrisonville man noticed that the water in his small pond was sloshing back and forth. He did not feel the ground move and was puzzled until he heard about the earthquake. This is similar to news media reports on this earthquake from Washington and Louisiana where bodies of water were also disturbed.

"Fortunately, the Nov. 3 quake did minimal damage in Alaska due to its remote location," said Mimi Garstang, state geologist and director of the department's Division of Geological Survey and Resource Assessment Division. "The occurrence should remind Missourians that we need to be concerned and prepared for the major effects of large earthquakes close to home, such as those that can be generated by the New Madrid seismic zone and other Mid-West earthquake source areas."

Understanding the nature and behavior of local earthquakes and applying that information to engineering design, construction and maintenance of manmade structures is essential to reducing the impact of earthquakes. It is failure of the manmade structures that cause most of the injuries, property damage and economic losses associated with earthquakes.

Citizens can submit on-line Internet reports on the effects of an earthquake to the U.S. Geological Survey at http://pasadena.wr.usgs.gov/shake/. You can view groundwater level monitoring network data for Missouri at http://waterdata.usgs.gov/mo/nwis/current/?type=gw. Click on one of the wells. Lawrence County – Aurora is a good example of an affected well.

For more information, please contact the department's Geological Survey and Resource Assessment Division at P.O. Box 250, Rolla, MO 65402, 573-368-2144, or by e-mail at nrhoffd@dnr.state.mo.us.--Bill Duley

QUATERNARY QUANDARY

What do you call it when you have a field conference with soil scientists with the Department of Natural Resources' Air and Land Protection Division's (ALPD) Soil and Water Conservation Program (SWCP), geologists with the Department of Natural Resources' Geological Survey and Resource Assessment Division (GSRAD), and a professor from Southwest Missouri State University? Collaboration, that's what! The people shown in these photos were all involved in a no-holds-barred field discussion about some of Missouri's younger glacial-drift deposits. Scientists have some disagreements over the particulars of glacial geology, but one thing they do agree about is that glaciers covered most of northern Missouri during parts of the Quaternary as far back as a couple million years. They also agree that not a lot of research has been done to determine the stratigraphic relationships of glacial drift in Missouri.

Chuck Rovey, Ph.D., with Southwest Missouri State University, recently presented his concepts of glacial stratigraphy of central Missouri to Mike Chalfont and Dennis Meinert (SWPC), and Bill Little, Myrna Rueff, Jim Brown and Bill Duley (GSRAD). The initial field trip this past summer was especially significant since it marked the beginning of a collaborative effort between SWCP and GSRAD to map surficial material in the state in conjunction with the U.S. Geological Survey Statemap program.

Some may ask, "what is surficial material anyway?" Surficial material is composed of the natural materials (clay, silt, sand, gravel, and boulders) that lie above consolidated rock. Most soils maps concentrate on the upper six feet of material while most geologic maps concentrate on the bedrock at depth. In Missouri, however, glacial drift may be as thick as 300 feet and locally is an essential aquifer and resource. Numerous public water supply districts and communities have drilled wells that tap the water stored in ancient alluvial channels in the drift. In many areas there is no other groundwater source that provides enough drinking water to supply the needs of municipalities.

To complicate the issue, even though Missouri's drift deposits are relatively young compared to bedrock, they are among the oldest on the continent. Many of the geomorphic features typically used to distinguish glacial drift have been obscured by the ravages of time. Our scientists obviously have a lot of work to do before they truly understand this material that connects the disciplines of soil science and geology but they are working together to solve this huge puzzle.—Bill Duley

Bill Little, Dennis Meinert, Chuck Rovey, and Mike Chalfont examine glacial drift -- up close and personal.

Jim Brown, Dennis Meinert and Chuck Rovey examine spruce log from the base of glacial deposits.

EARTH SCIENCE WEEK

Attending the signing of the Earth Science Week Proclamation for Rolla were (back row, l to r) Steve Sturgess, Anita Studdard, Mimi Garstang, Bill Duley, Nona Lancaster, Candice Stanley; (front row, l to r) Shae Grisham, Laura Studyvin, Mayor Joe Morgan, Jacob Sells and Ryan Wilkerson.

Rolla Mayor Joe Morgan has joined the Missouri Department of Natural Resources in recognizing October 13-19 as Earth Science Week. Earth Science Week has been celebrated on a national level for the past three years and is sponsored by the American Geological Institute and state geological surveys across the country. Mimi Garstang, State Geologist and Director of the Geological Survey and Resource Assessment Division of the Missouri Department of Natural Resources sponsored the proclamation signed by Mayor Morgan. "I urge all citizens to recognize the importance of earth science information," said Garstang.

The purpose of Earth Science Week is to recognize the important role that earth sciences play in our everyday lives. This year there was specific emphasis on how earth science information assists scientists in protecting our water resources. The disciplines of geology, hydrology, land surveying and engineering play fundamental roles in the health and welfare of all Missourians. "A good understanding of natural processes is vital to understanding environmental issues because we all make choices that impact the use and conservation of our natural resources," said Garstang. "The more students understand about earth sciences, the better they will be equipped for making important environmental decisions in the future.

Shae Grisham, Laura Studyvin, Jacob Sells, and Ryan Wilkerson, four of Rolla Middle School's brightest science students, witnessed the signing of the proclamation in the school library. Anita Studdard, middle school principal, and Candice Stanley, 6th grade science teacher, also participated in the ceremony in an effort to reinforce the values of effective science education.

Governor Bob Holden signed an Earth Science Week proclamation for Missouri on October 4, 2002, in Jefferson City.

Staff from the Geological Survey and Resource Assessment Division attending included Bill Duley, deputy director of the division; Steve Sturgess, geological survey program director; and Nona Lancaster, administration program director.

SCHOOLS TOUR DEPARTMENT OF NATURAL RESOURCE FACILITIES IN ROLLA

On September 19, 2002, approximately 55 students and teachers from St. Joseph's School in Westphalia, Missouri, and on November 6, 2002, approximately 20 students and teachers from Sacred Heart School in Rich Fountain, toured the Missouri Department of Natural Resources Geological Survey and Resource Assessment Division in Rolla, MO. Students from the 6th, 7th, and 8th grades toured the division's facilities to view the building's educational displays on Missouri's natural resources. The tours, lead by staff geologists from the Water Resources and Geological Survey Programs, provided opportunities for the students to view rock and mineral samples, fossils and interactive displays. Students were also given the opportunity to ask questions about the types of work done by staff and why that work is important for our state. The students viewed the inside of a drilled water well through the use of a down-hole, waterproof camera. The division drilled a demonstration well on their property in order to teach the public about the importance of proper well construction. Geologists use their "down-hole" camera equipment to identify problems with well construction that may affect the public's source of drinking water.

Visitors to the division can take self-guided tours of the facilities, Monday – Friday, 8:00 – 5:00. Guided tours for groups must be prearranged by contacting Nona Lancaster, Acting Division Information Officer at 573-368-2100. The division also provides maps, publications, brochures, and other documents on many natural resource issues. For more information, visit the division at 111 Fairgrounds Rd., Rolla, MO or for a listing of publications on the web go to www.dnr.state.mo.us/geology/adm/publications/index.html.

Staff geologist Matt Parker demonstrates the use of a down-hole camera. Students examine core rock samples obtained from the well.

UPCOMING MEEGINGS

Missouri River Corps, Coast Guard and Navigator's Conference, Feb. 12, 2002, Kansas City, Missouri. For more information call Mike Wells at (573) 751-2867.

Upper Mississippi, Illinois, and Missouri River Association (UMIMRA) Annual Meeting, Feb. 13, 2002, Quincy, Illinois. For more information call Mike Wells at (573) 751-2867.

The Department of Natural Resources' Geological Survey and Resource Assessment Division's Sesquicentennial Celebration Reception, Feb. 24, 2002, Jefferson City, Missouri. For more information call Nona Lancaster at (573) 368-2123.

Upper Mississippi River Basin Association (UMRBA) Meeting, Feb. 25-27, 2002, Rock Island, Illinois. For more information call Holly Stoerker at (651) 224-2880.

Wellhead Installation Board Meeting, Feb. 27, 2002, Lake of the Ozarks, Missouri. For more information call Jeannie Hoyle at (573) 368-2450.

Association of American State Geologists (AASG) Spring Liason Committee Meeting, March 16-19, 2002, Washington D.C. For more information call Vicki Cowart at (303) 866-2611.

Central United States Earthquake Consortium Meeting, March 25-26, 2002, Nashville, Tennessee. For more information call Dave Hoffman at (573) 368-2144.

Missouri River Basin Association (MRBA) Meeting, April 10-11, 2002, Nebraska City, Nebraska. For more information call Richard Opper at (406) 538-4469.

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